Ingeteam

COMMUNICATION ACCESSORIES

Accessories Installation Manual

Ref: AAX2002IK01 Rev: _A

Ingeteam Energy S.A. 06/2010

Note: In its commitment to ongoing product improvement, Ingeteam Energy S.A. reserves the right to amend this document with no prior notice.

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Related documentation

CATALOGUES

Ingecon® Sun
Commercial Catalogue

PC00ISA01_A

MANUALS

Ingecon® Sun LITE
Installation Manual

AAY2000IKI01

Ingecon® Sun POWER
Installation Manual

AAS2000IKI01

Three-Phase IP54
Ingecon® Sun
Installation Manual

AAS2000IKI03

Ingecon® Sun SMART
Installation Manual

AAS2000IKI02

Ingecon® Sun
POWERMAX
Installation Manual

AAV2000IKI01

Communication
Accessories
Installation Manual

AAX2002IKI01

Ingecon® Sun Manager
User's Manual

AAX2005IKL01

Single-phase
Ingecon® Sun Hybrid
Installation Manual

AAR2000IKI01

Ingecon® Sun Hybrid MS
Installation Manual

AAR2000IKI01

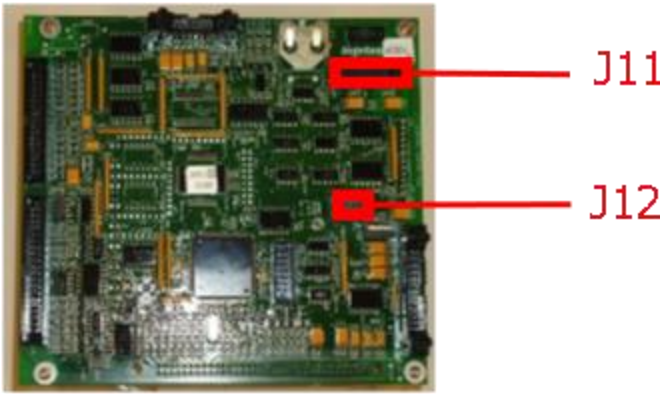
Ingecon® Sun
String Control
Installation Manual

AAS2002IKI01

1. INTRODUCTION

There are a number of ways in which the Ingecon Sun equipment can be monitored through the J11 and J12 connectors on the inverter control electronics board. The control board is mounted over the power board, connected by four divider posts.

Marked in red, the control board and locationof the communication accessories on connectors J11 and J12:



2. LIST OF ACCESSORIES

The following accessories and modification kits are available:

AAP0022	For RS-485 communication with Ingecon Sun Smart, Ingecon Sun Power, Ingecon Sun PowerMax units and three phase inverter models prior to 2009.
AAP0034	For RS-485 communication with single phase models prior to 2009.
AAP0057	USB-RS-485 Converter.
AAP0058	RS232-RS-485 Converter.
AAP0059	GSM external modem
AAP0067	For Ethernet communication with Ingecon Sun Smart, Ingecon Sun Power, Ingecon Sun PowerMax units and all equipment prior to 2009.
AAS0173	For Ethernet communication with Ingecon Sun Smart 15 UL and Ingecon Sun Smart 25 UL units.
AAS0174	For Ethernet communication with Ingecon Sun Power 100 UL units.
AAX0001	For GPRS communication with Ingecon Sun Smart, Ingecon Sun Power, Ingecon Sun PowerMax units and three phase inverter models prior to 2009.
AAX0004	For Ethernet communication with Ingecon Sun Smart, Ingecon Sun Power, Ingecon Sun PowerMax units and three phase inverter models prior to 2009.
AAX0005	For wireless communication with the Ingecon Sun Smart, Ingecon Sun Power, Ingecon Sun PowerMax units and three phase inverter models prior to 2009.
AAX0006	Ingecon Sun Combox centralised communication hardware.
AAX0007	For GSM communication with single phase inverter models prior to 2009.
AAX0009	For wireless and RS-485 communication with Ingecon Sun Smart, Ingecon Sun Power, Ingecon Sun PowerMax units and three phase inverter models prior to 2009.
AAX0011	Logical Zone Modification Kit in radio AAX0005.
AAX0012	Logical Zone Modification Kit in radio AAX0009 for AAX0006.
AAX0013	Radio Kit for AAX0006.
AAX0014	GPRS modem kit for AAX0006.
AAX0018	1900MHz band kit for GPRS modem.
AAX0022	For GPRS communication with Ingecon Sun Lite units.
AAX0023	For Ethernet communication with Ingecon Sun Lite units.
AAY0013	Harting type push-pull connector for Ingecon Sun Lite units.

3. INVERTER IDENTIFICATION

It is absolutely essential to use a different identifier number for each and every inverter with which communication is to be established. To change the inverter node number, please refer to the appropriate installation manual.

- Ingecon Sun Lite single phase models. Refer to document AAY2000IKH01.
- Ingecon Sun Smart (10-30 kW) three phase models. Refer to document AAS2000IKH02.
- Ingecon Sun Power (50-100 kW with transformer) three phase models. Refer to document AAS2000IKH01.
- Ingecon Sun PowerMax (Modular, 100TL and 125TL) three phase models. Refer to document AAV2000IKH01.
- Ingecon Sun String Control box. Refer to document AAS2002IKH01.
- Single phase models prior to 2009. Refer to document AAP2000IKH01.
- Three phase models of 100 kW or more, prior to 2009. Refer to document AAV2000IKH01 supplied with the equipment.
- Other three phase models prior to 2009. Refer to document AAS2000IKH01 supplied with the equipment.

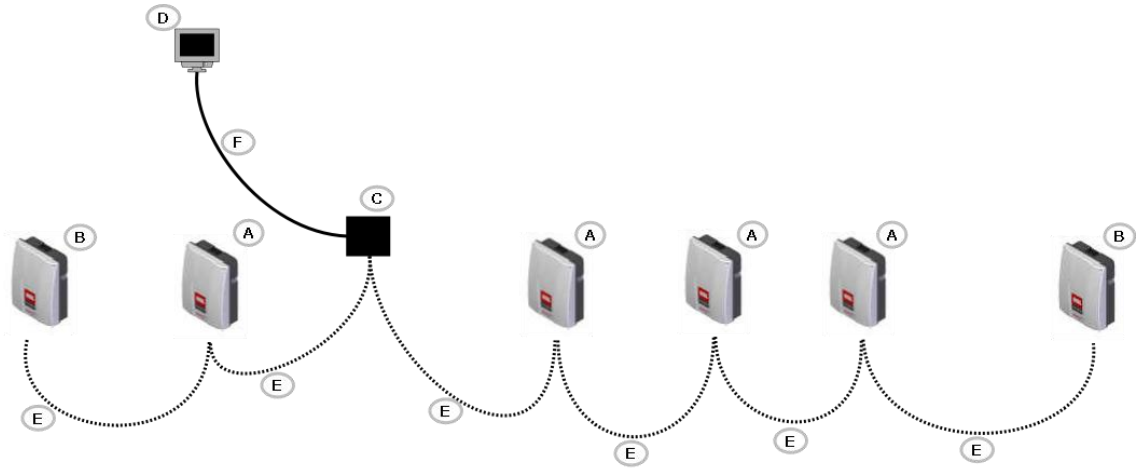
4. GENERAL SAFETY CONDITIONS

Please read section 9 and always refer to the installation manual corresponding to the Ingecon Sun equipment in which the communication accessory is to be installed.

5. LOCAL COMMUNICATION

5.1 Communication through the RS-485 serial line

The RS-485 local communication schema is as follows:



With inverters **B** and **A** connected by bus and media converter **C** connected to a local PC - **D**. **E represents the RS-485** cabling whilst, depending on converter **C**, the **F** cabling can either be RS232, USB or Ethernet.

5.1.1 General comments

RS-485, as the EIA-485 standard is generally known, defines the electrical characteristics of transmitters and receivers in a local, low cost digital communications system in noisy environments. Its high noise immunity is due to the differential communication mode, in other words the data is transmitted over a single two wire, normally twisted, pair. The EIA-485 standard defines the B signal as the "Non inverting" or positive (+) pin whilst the A signal is the inverting or negative (-) pin.

Solar PV plant cabling generally carries high energy flows which can negatively affect communication. Ingeteam recommends a careful plant design to ensure that the data lines are as far apart as possible from the power lines and that the total cabling length is kept to a minimum.

5.1.1.1 Topology

The recommended cabling arrangement is a series of consecutive nodes, also called a bus or line configuration. A star, ring or multiply connected network is not recommended. Ingeteam Energy also advises you not to be conservative in the number of nodes in each bus, by not connecting more than 30 items of equipment.

In a bus topology, it is best to have the master centrally located in the bus, in order to ensure optimum signal strength to as many slaves as possible.

5.1.1.2 Speed

The communication speed in the Ingecon Sun units is 9600bps.

5.1.1.3 Half Duplex

In the Ingecon Sun units, communication via the RS-485 line is made with two wires in the Half Duplex mode. In this configuration, the same pair of wires is used for the data sent and that received, with the Ingecon Sun Manager software being responsible for ensuring that two devices to not simultaneously access the bus.

5.1.1.4 Cabling

A "shielded twisted pair" type cable is recommended, with a characteristic impedance of 100 - 120 Ohm, for example the Unitronic Bus IBS 2x2x0.22, made by LappKabel. A twisted pair should be used for the B (+) and A (-) signal pair, and another for the GND.

Although the data is transmitted over a two-wire pair, the cabling of a GND is also necessary to provide a common voltage reference for all the devices connected to the bus. Some manufacturers forget this fact and only supply two wires, which could create problems.

The third twisted pair remains free, but a cable of this type is recommended due to the lower cost and greater availability, compared to two pairs. If in doubt, consult your cable supplier.

5.1.1.5 End of line

The standard recommends that, at either end of the RS-485 cabling, in this case the inverters marked as **B**, 120 ohm end of line resistors should be installed. The various Ingecon Sun range models already incorporate the said resistors.

Ingecon Sun Lite – The installation is made at the Harting connector of Kit AAY0013.
Single phase units prior to 2009, refer to section 5.1.2.1
Other equipment, refer to section 5.1.2.2

5.1.1.6 Protective shield

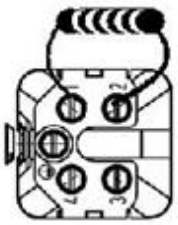
The cable shield is intended to protect communications from electrical noise, however its use and utility is controversial. Initially, and for each cable section installed, only take the mesh to GND on one of the section ends.

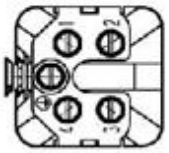
5.1.2 RS-485 accessories for Ingecon Sun

5.1.2.1 AAP0034

Reference AAP0034 corresponds to communications board AAP0022, supplied together with the internal cable and the Harting type fast-on connector required for the RS-485 serial line communication for installation in single phase equipment prior to 2009.

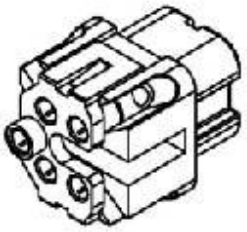
The 120 Ohm end resistance for end of line equipment is supplied for mounting with no need to open the equipment. Mount the Harting push-pull connector supplied by Ingeteam Energy between pins 1 and 2.

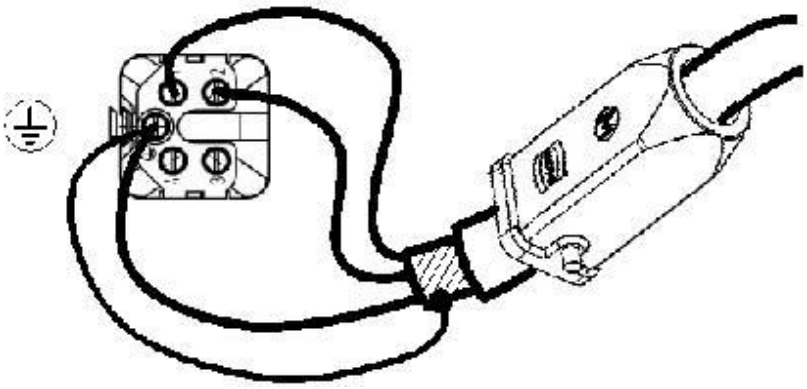




The Harting connector pins correspond to:

Pin	Signal
1	RS-485 B (+)
2	RS-485 A (-)
5	GND



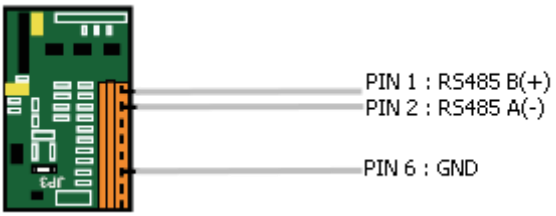


5.1.2.2 AAP0022

Reference AAP0022 corresponds to the supply of the communications board required for the RS-485 serial line communication.

The terminals of the cable connector correspond to:

Pin	Signal
1	RS-485 B (+)
2	RS-485 A (-)
6	GND



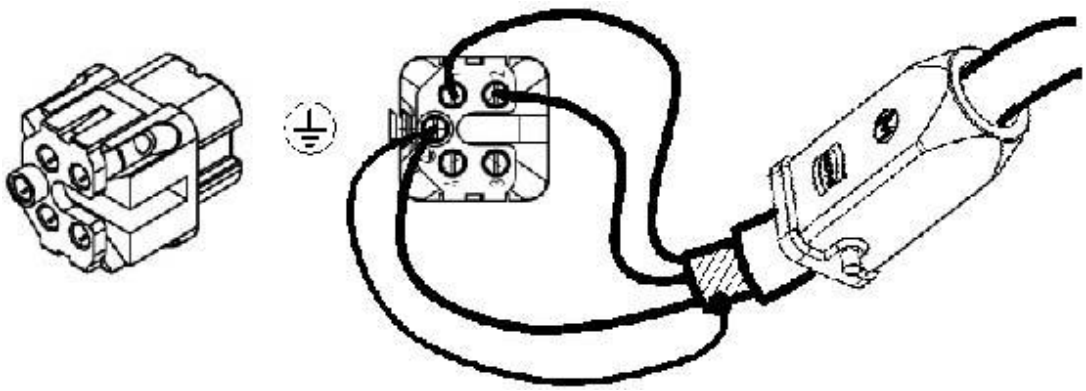
Jumper JP3 is the end of line resistor. This P3 Jumper must be closed on the end of line inverter.

5.1.3 RS-485 communication in the Ingecon Sun units

5.1.3.1 Ingecon Sun Lite

The Ingecon Sun Lite offers RS-485 communication with no need to install the additional RS-485 AAX0022 board or open the unit.

To make the RS-485 connection with another inverter and / or media converter for the PC connection, the installer will need to remove the protective cover and mount a Harting type push-pull connector as indicated in the figure. Ingeteam Energy will supply this connector together with the Ingecon Sun Lite if you included reference AAY0013 with the equipment order.

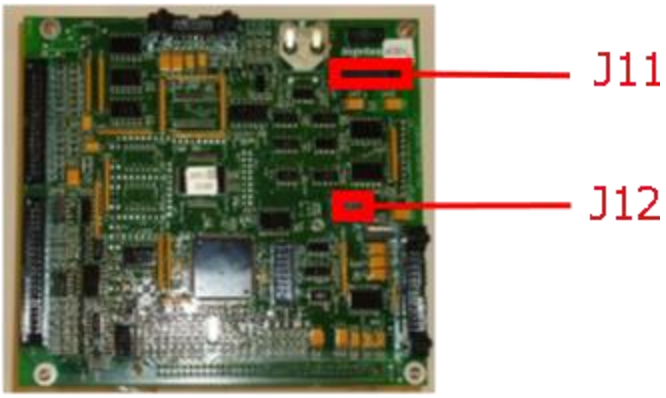


The Harting connector pins correspond to:

Pin	Signal
1	RS-485 B (+)
2	RS-485 A (-)
5	GND

5.1.3.2 Ingecon Sun Smart, Power and PowerMax

Communications card AAP0022 must be mounted on the control board specific communications connector.



The cabling shall be made to the board push-pull connector. There is no defined position on the equipment housing for bringing out the cabling, however there are a number of ports available.

5.1.3.3 Ingecon Sun String Control

Communications card AAP0022 must be mounted on the String Control electronics board specific communications connector and the cabling shall be made to the board push-pull connector. The RS-485 cabling shall be passed through the PG cable gland available for this purpose.

5.1.3.4 Models prior to 2009

Refer to the previous version of this document: AAX2002IKH01_B.

5.1.4 Connection of the local PC and RS-485 PC accessories

Given the fact that the PC does not incorporate an RS-485 port, a converter is required to connect the bus formed by the Ingecon Sun equipment.

To connect the group of inverters to the PC, use an off-the-shelf RS-485 to RS-232 or USB converter, configured in the «Multipoint» mode and «Two wire, Half Duplex» or else the «AAP0057» and «AAP0058» supplied by Ingeteam Energy.

5.1.4.1 AAP0057 USB to RS-485 converter

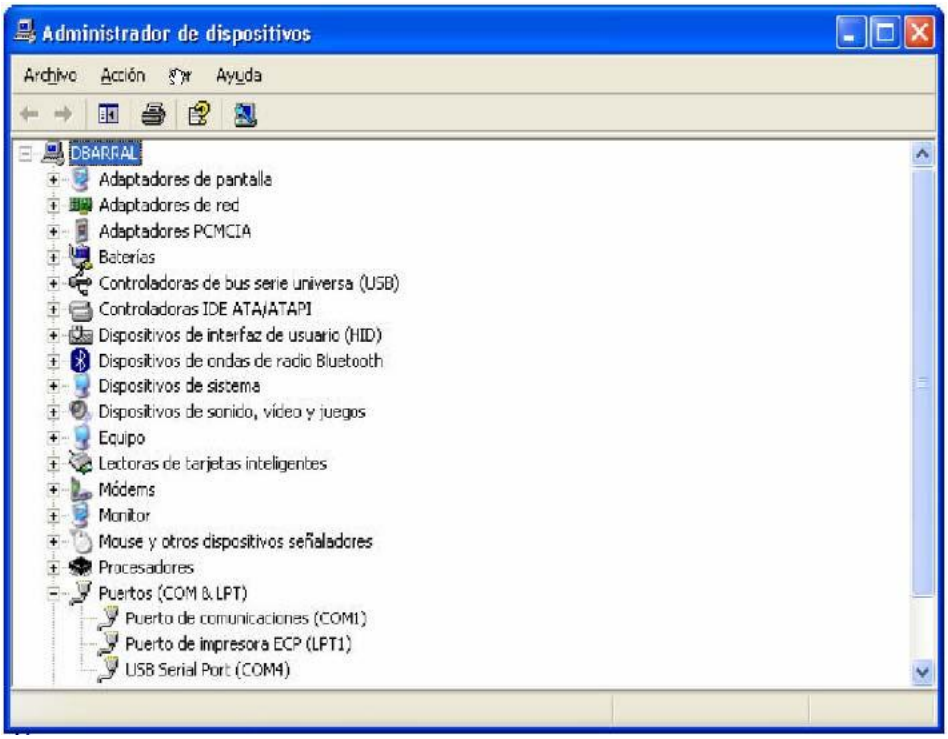
Reference AAX0057 corresponds to the supply of a USB to RS-485 converter for connection to a PC with Windows XP or later.

5.1.4.1.1 Installation of the driver

• Connect the converter to the computer USB port. The installation will start automatically and CD-ROM should be selected as the driver source.

• The installation will prompt for the drivers again, and the same source should be indicated.

• Once completed, open the device manager (**Administrador de dispositivos)** from the control panel or else from the execute option in the start menu: **Menú de Inicio -> Ejecutar** ... and enter **devmgmt.msc.**



• In ports **Puertos (COM & LPT)** you will see the new **COMx** port that the system has associated with the converter, named **USB Serial Port** or **FTDI USB Serial Port** (depending on the driver version). This port number will be used in the Ingecon Sun Manager configuration.

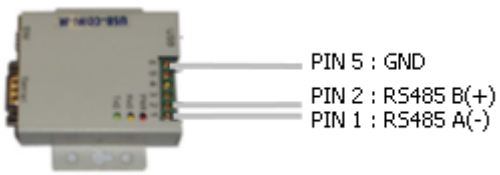
5.1.4.1.2 Settings

• The settings of the side switches must always remain as shown in the following figure:

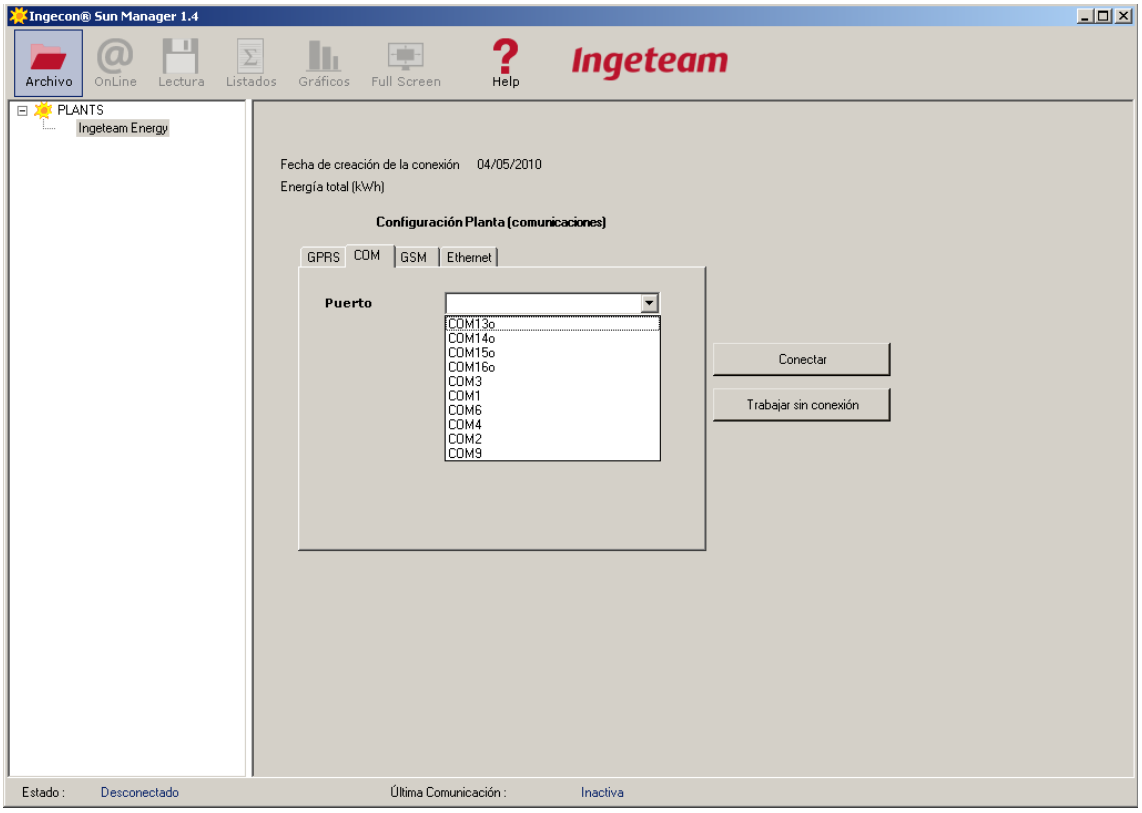
PIN 1	PIN 2	PIN 3	PIN 4
ON	OFF	OFF	OFF

5.1.4.1.3 Connections

• Connect the two terminals on the terminal strip to the communications board, by pairing converter terminal 2 to pin 1 of the communications board, and terminal 1 to pin 2.



• The monitor program is configured in **Opciones -> Configuración comunicaciones** (options - communications settings) by selecting the port number corresponding to the converter.



5.1.4.2 AAP0058 - RS-485 to RS-232 Converter

Reference AAP0058 corresponds to the supply of an RS-232 to RS-485 converter for connection to a PC serial port.

5.1.4.2.1 Settings:

Set the converter switches as follows:

• Left to "T-RTS, R-/RTS" (central position)

• Right to DCE (top position)

5.1.4.2.2 Connections

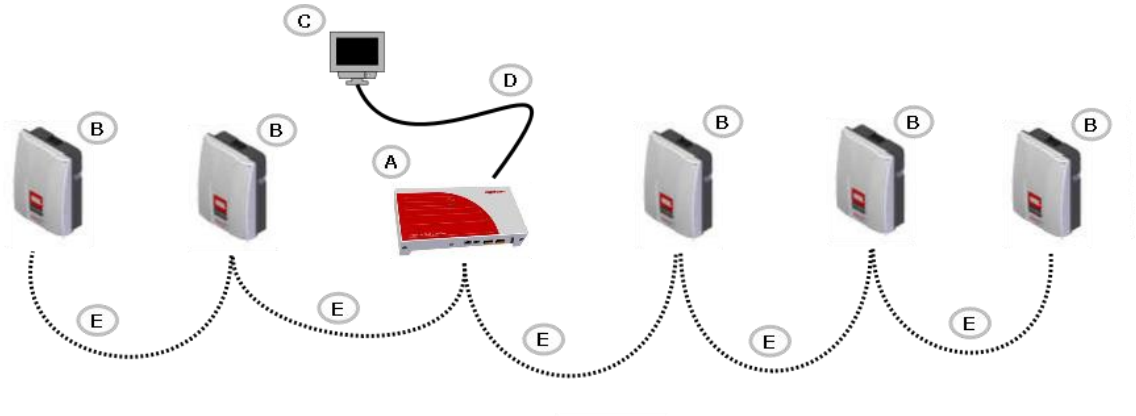
•Connect the converter to the PC.

•Configure it for half duplex communication by connecting converter pins 1(T+) and 4(R+) to communications board pin 1 and terminals 2(T-) and 3(R-) to pin 2.

•Power-up the converter.

5.1.4.3 Ingecon Sun Combox

The Ingecon Su Bombox can be used as shown in the following figure:



A - Ingecon Sun Combox.

B –Ingecon Sun units connected to the bus

C – PC local.

E –RS-485 cabling.

D - USB or RS-485, or Ethernet Cable.

Refer to section 7 for further information on the Ingecon Sun Combox Centralised communication hardware.

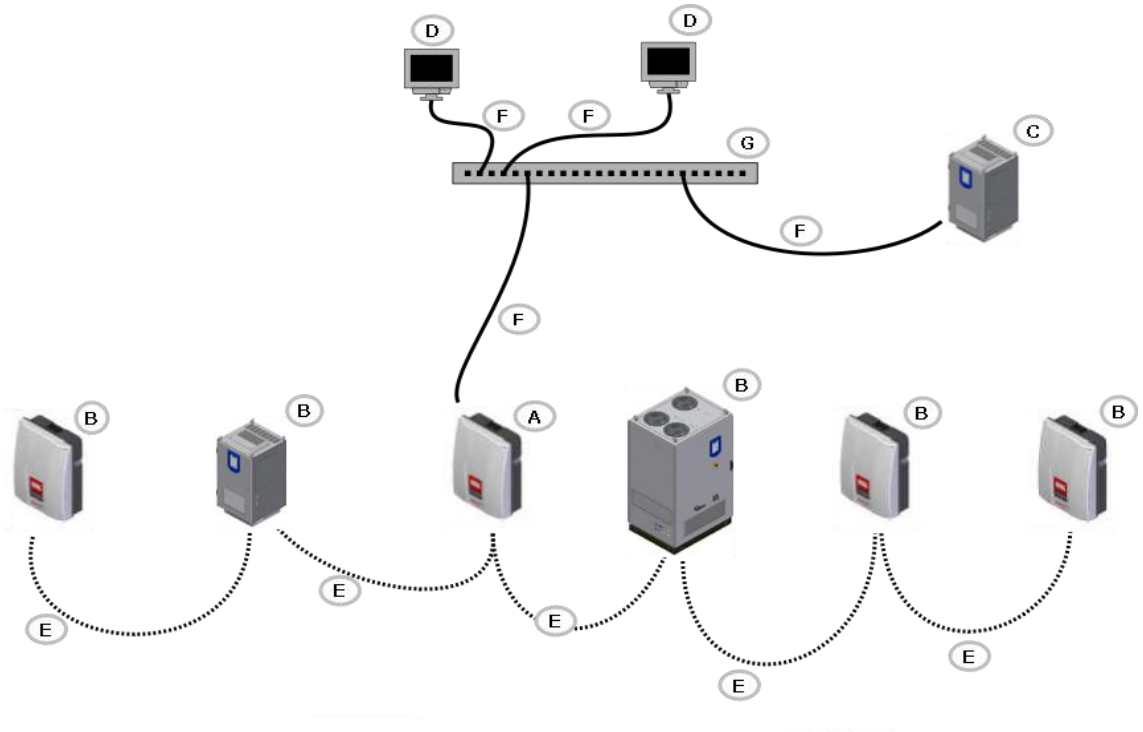
5.2 Local Ethernet communication

All the Ingecon Sun Ethernet communication accessories incorporate Ethernet to serial port conversion hardware and have a similar operation, set by default.

They have a fixed IP address assigned and are programmed as TCP servers to accept a connection from the Ingecon Sun Manager client software. The default port number through which connections are received is **7218**. Only one client at a time is accepted.

For local communication, the following is required:

The serial Ethernet converter in equipment **A** and local computers **D** must be in the same sub-network.
The number of the TCP port in which the converter accepts connections.
There are not two or more devices with the same IP address.



A – Ingecon Sun with AAX0004 (Ethernet and RS-485 communications card), or Ingecon Sun Lite with AAX0023 (Ethernet and RS-485 communications card), or Ingecon Sun Smart 15 UL with kit AAS0173, or Ingecon Sun Smart 25 UL with kit AAS0173, or Ingecon Sun Power 100 UL with kit AAS0174.

B –Ingecon Sun units connected to the same bus as **A**.

C –Ingecon Sun units with AAP0067 (Ethernet communications card).

D – Local PCs.

E –RS-485 cabling.

F –Ethernet cabling.

G – Network switch.

5.2.1 Ingecon Sun Ethernet accessories

5.2.1.1 AAX0023

Reference AAX0023 corresponds to the supply of board AAX0004, communications cable RS-485 AQL0089, flat cable AQL0090, and the PG cable gland required to guarantee the leak tightness of the equipment at the Ethernet cable inlet connection.

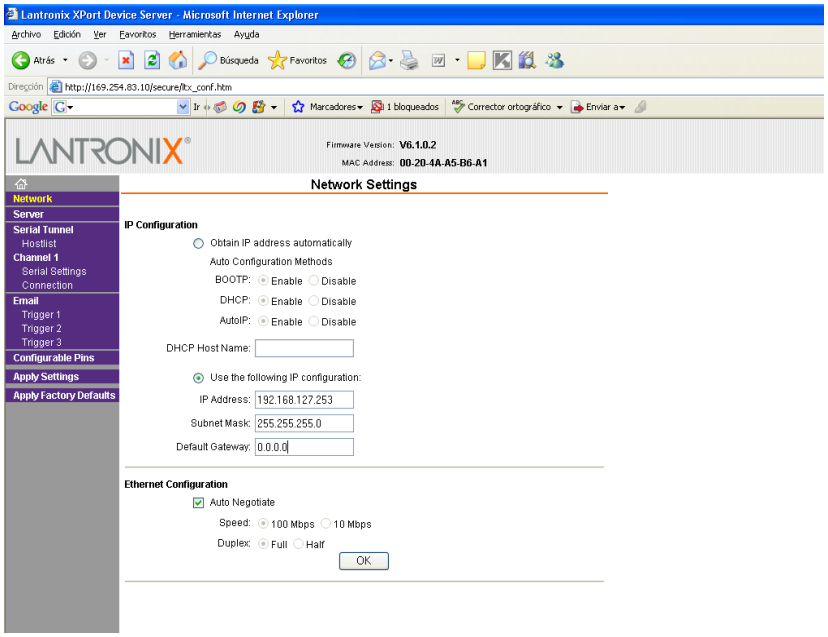
5.2.1.2 AAX0004

Communications board AAX0004 / AAX0023 RS-485 interface permits Ethernet communication with a number of Ingecon Sun units connected in a bus configuration. It is factory set with IP address IP 192.168.127.253. This accessory does not incorporate the alarm or report sending functions.

Push-pull pin	Signal
1	RS-485 B (+)
2	RS-485 A (-)
6	GND

5.2.1.2.1 Settings

To change this address, open the Internet navigator and enter http://192.168.127.253. A Log-in prompt will appear in which neither the user name or password need to be entered. This takes you to the following page:



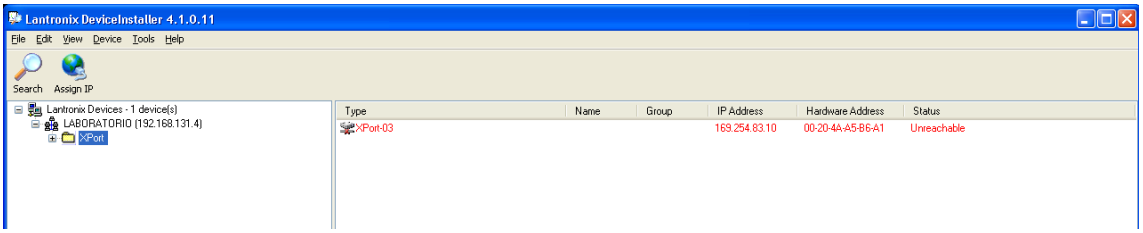
The IP address can be changed in the "Network" section. After changing this, do not forget to click on "Apply Settings".

5.2.1.2.2 Restoring the IP

The AAX004 board incorporates the Ethernet series TTL XPORT-03 manufactured by Lantronix. If you do not know the IP address configured in the converter, you can use the “Device Installer” software provided by Lantronix to make a MAC level search.

The ‘deviceinstaller’ search on the Lantronix web returns links to the software download page. Install and proceed as shown in the following image.

Click on ‘Search’.

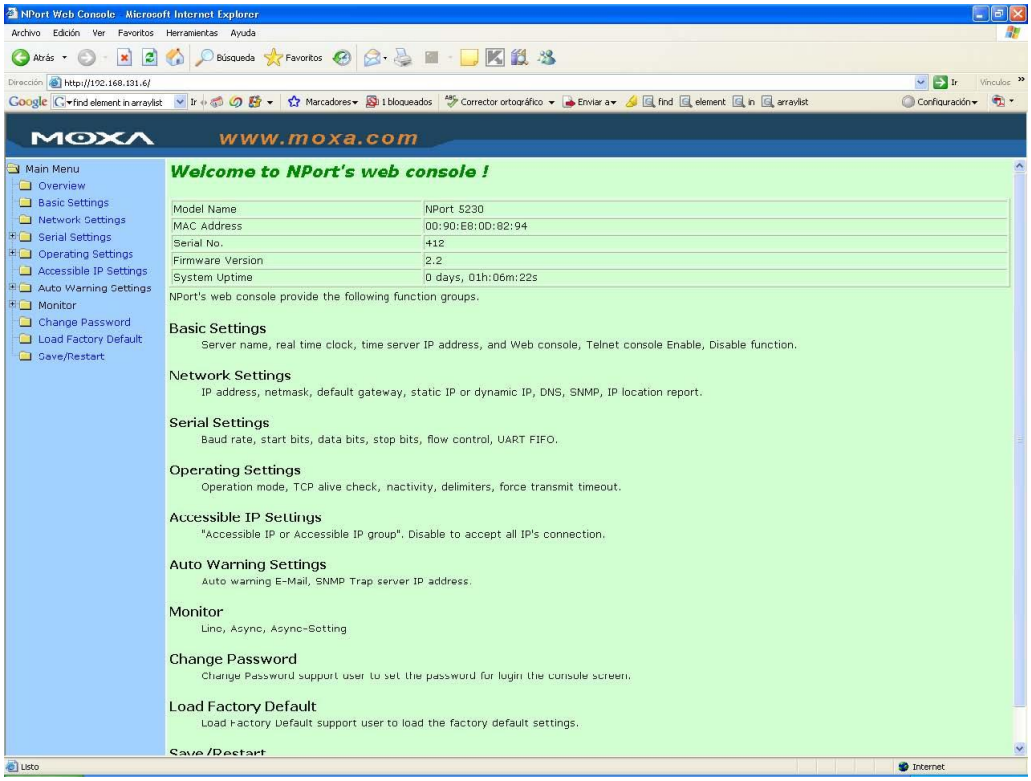


5.2.1.3 AAP0067

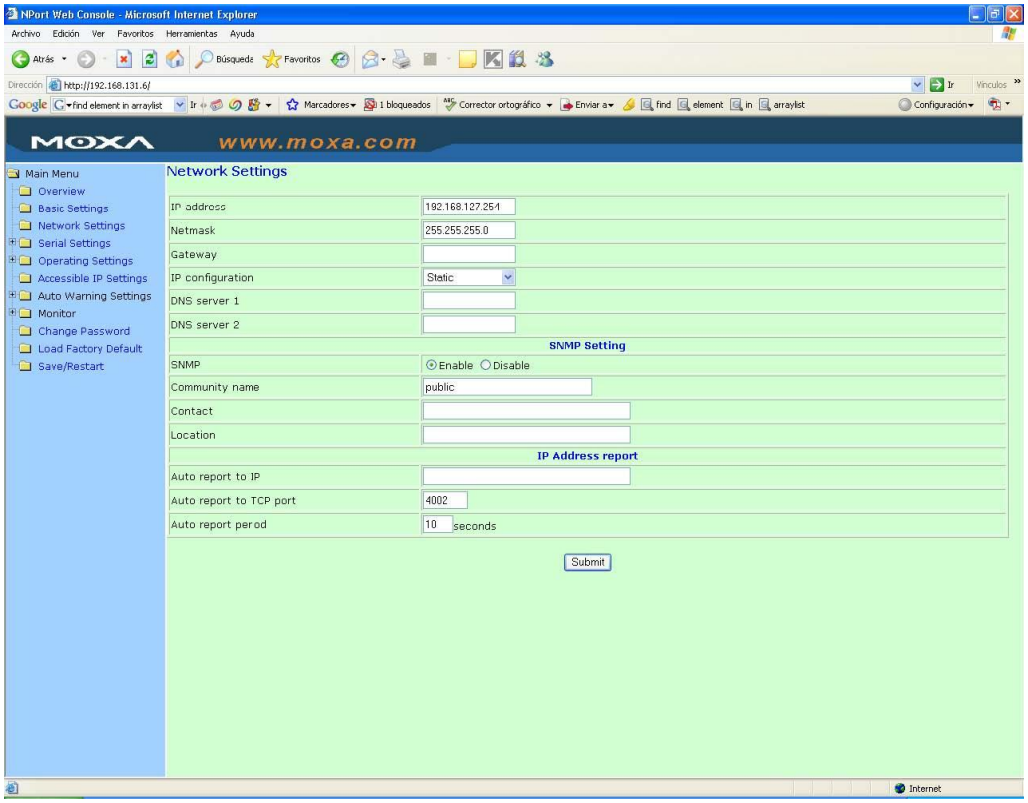
Board AAP0067 offers Ethernet to serial conversion for a single Ingecon Sun unit. It is factory set with IP address 192.168.127.254.

5.2.1.3.1 Settings

If you want to change this address, you need to open the Internet navigator and enter http://192.168.127.254. The following page will appear:


NPort Web Console Microsoft Internet Explorer
MOXA
www.moxa.com
Main Menu
Overview
Basic Settings
Network Settings
Serial Settings
Operating Settings
Accessible IP Settings
Auto Warning Settings
Monitor
Change Password
Load Factory Default
Save/Restart
Welcome to NPort's web console !
Model Name NPort 5230
MAC Address 00:90:E8:0D:82:94
Serial No. 412
Firmware Version 2.2
System Uptime 0 days, 01h:06m:22s
NPort's web console provide the following function groups.
Basic Settings
Server name, real time clock, time server IP address, and Web console, Telnet console Enable, Disable function.
Network Settings
IP address, netmask, default gateway, static IP or dynamic IP, DNS, SNMP, IP location report.
Serial Settings
Baud rate, start bits, data bits, stop bits, flow control, UART FIFO.
Operating Settings
Operation mode, TCP alive check, nactivity, delimiters, force transmit timeout.
Accessible IP Settings
"Accessible IP or Accessible IP group". Disable to accept all IP's connection.
Auto Warning Settings
Auto warning E-Mail, SNMP Trap server IP address.
Monitor
Line, Async, Async-Setting
Change Password
Load Factory Default
Load Factory Default support user to load the factory default settings.

To change the IP address, access the Network Settings folder and click on the "Submit" button to apply the changes.

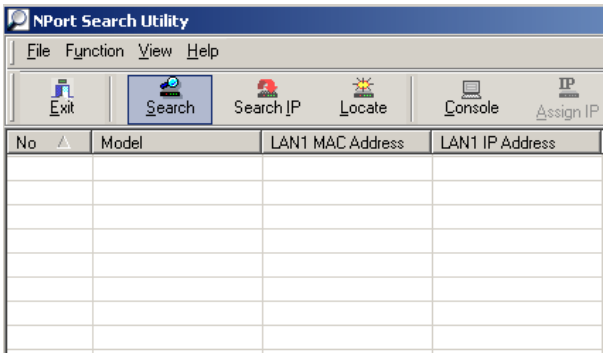


5.2.1.3.2 IP restoration

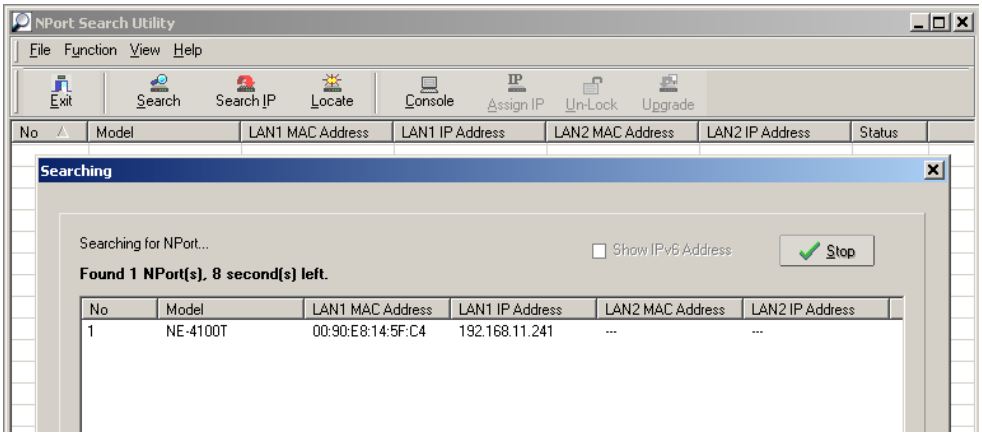
Board AAP0067 incorporates the Ethernet - serial converterTTL NE-4100T manufactured by MOXA. If you do not know the IP address configured for the converter, you can use the “NPort Search Utility” software supplied by Moxa to make a MAC level search.

The ‘NPort Search Utility 4100’ on the Moxa website returns the link to the installation file. Install and proceed as shown in the following images:

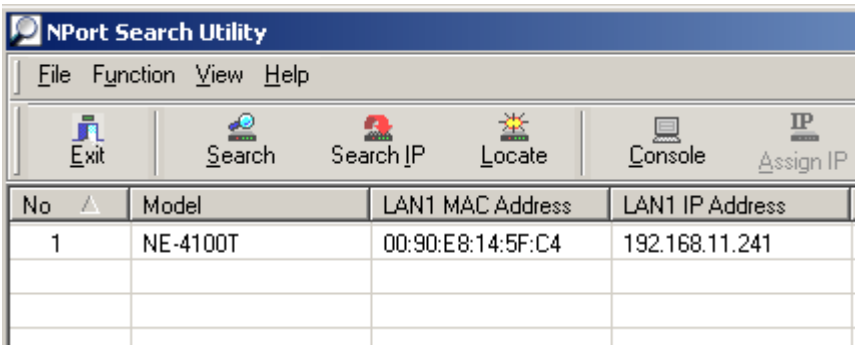
Click on ‘Search’:



A dialogue is shown and which will look for devices during 10 seconds:



And will finally present the results.



5.2.1.4 AAS0173

The 25-15kW UL units can optionally be supplied with kit AAS0173 for Ethernet communication. It incorporates an Ethernet - RS-485 converter to be used like the AAX0004, providing Ethernet connectivity to all the units connected in a bus configuration.

5.2.1.5 AAS0174

The 100kW UL can optionally be supplied with kit AAS0174 for Ethernet communication. It incorporates an Ethernet - RS-485 converter to be used like the AAX0004, providing Ethernet connectivity to all the units connected in a bus configuration.

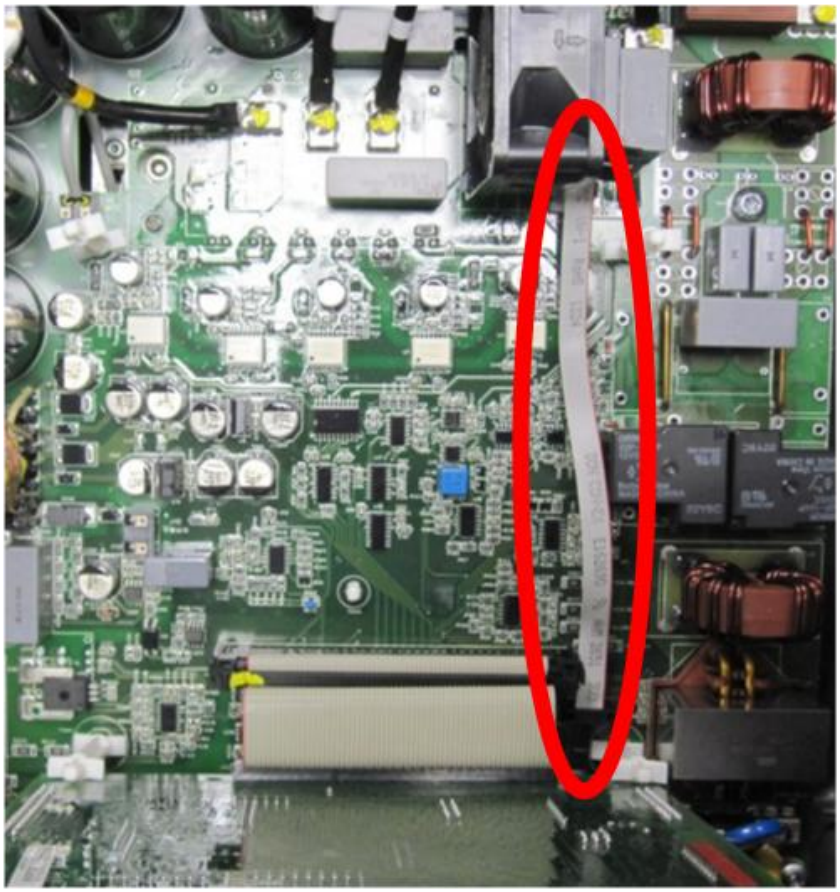
5.2.2 Ethernet communication with the Ingecon Sun units

5.2.2.1 Ingecon Sun Lite

In order to install an Ethernet communication card in the Ingecon Sun Lite units, you first need to disable the RS-485 communication, installed as standard. To do so, proceed as described in 5.2.2.1.1. You can then install the accessory.

5.2.2.1.1 How to disable the factory set RS-485 communication

The following photo (with the inverter control card removed) shows the location of lead AQL0053 which must be removed in order to disable the RS485 communication through connector J19 on the power board.



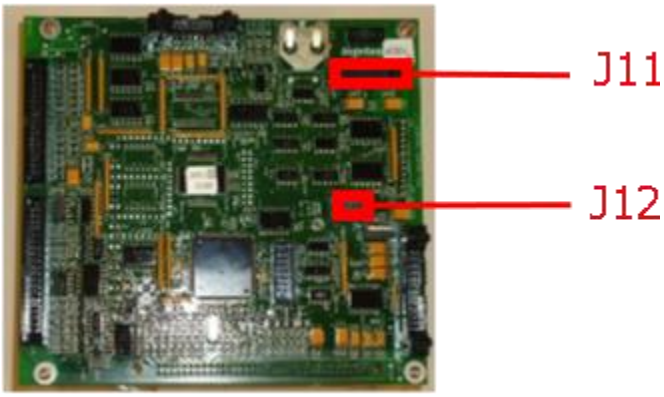
This must be replaced by cable AQL0090 supplied with the Ingecon Sun Lite communication accessories.

5.2.2.1.2 Installation

Remove the blank shown in the photo from the Ingecon Sun Lite housing and fit a 20 diameter PG cable gland through which the Ethernet Cabling will pass.

5.2.2.2 Ingecon Sun Smart, Power and PowerMax

Communications board AAP0067 / AAX0004 must be mounted on the control board specific communications connector.



The cabling shall be made to the board push-pull connector. There is no particular position defined on the equipment housing for taking out the cabling, however there are a number of ports available to do so.

5.2.2.3 Ingecon Sun Power UL and PowerMax UL

For these units, Ethernet communication is available, to order, through an off-the-shelf Ethernet to serial converter which is factory set with the IP address IP 192.168.127.254 and, like the rest of the Ethernet communication accessories, it receives TCP connections at port 7128.

5.2.2.4 Ingecon Sun String Control

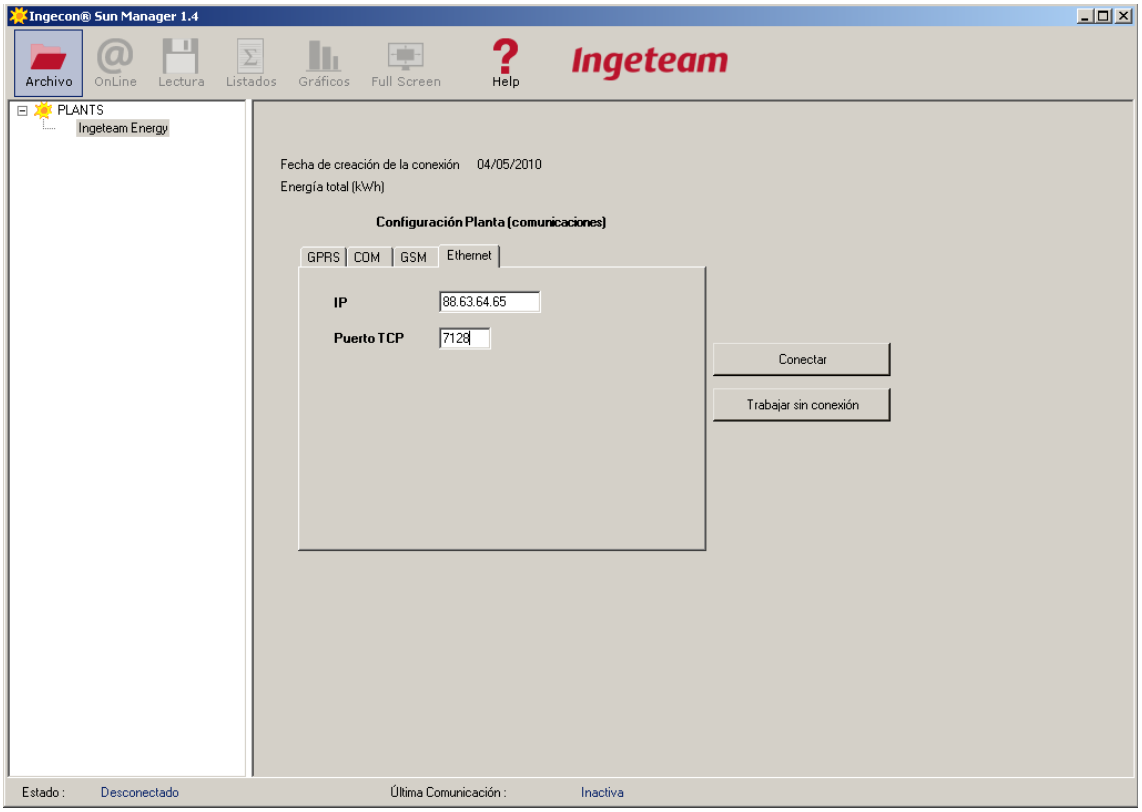
Communications board AAP0067 or AAX0004 must be mounted on the specific communications connector on the String Control electronics board, and the cabling shall be made to the board push-pull connector. The RS-485 cabling shall be taken out through the PG cable gland designed for this purpose.

5.2.2.5 Models prior to 2009

Use the earlier version of this document, AAX2002IKH01_.

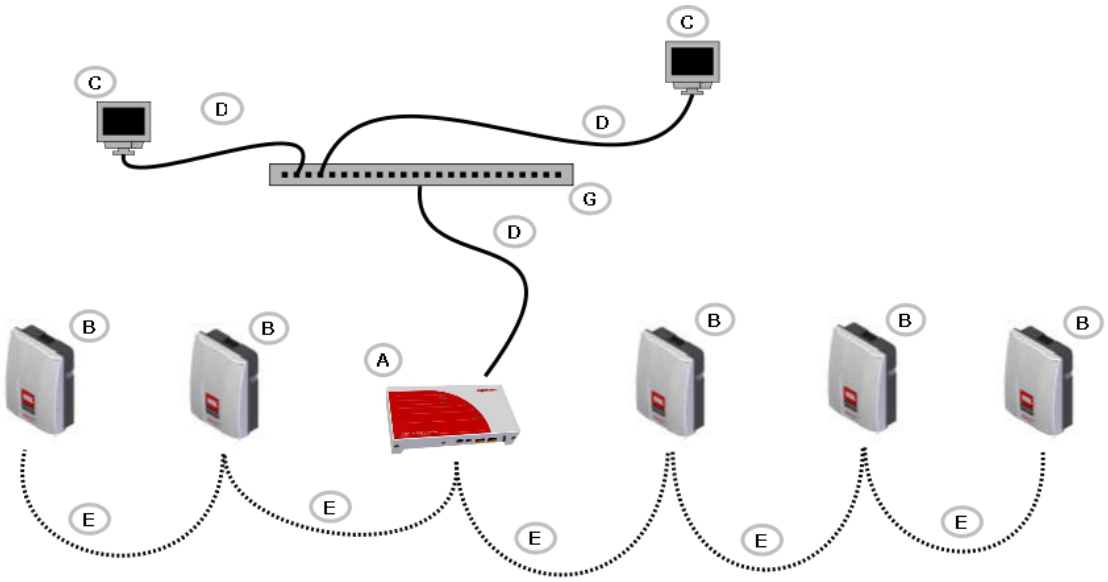
5.2.3 Local PC connection

Open the Ingecon Sun Manager software on the PC and, on the right hand communication settings panel, select Ethernet as the means of communication and enter the IP address for the communication accessory and the port nº.



• Then connect by clicking on button "**Conectar**".

5.2.3.1 Ingecon Sun COMBOX



A - Ingecon Sun Combox.

B – Ingecon Sun units connected to the bus.

C –Local PCs

E –RS-485 Cabling.

D - Ethernet Cabling.

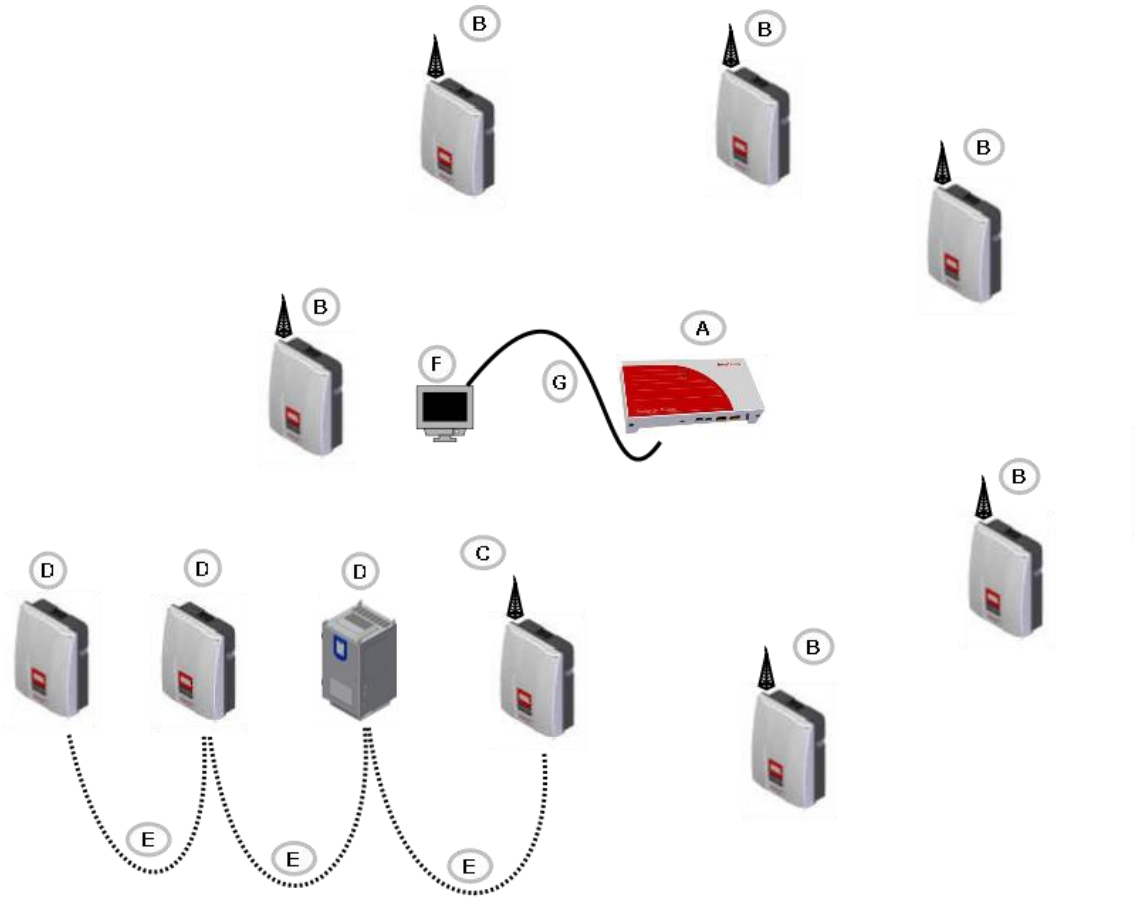
G – Local network switch.

The Combox Ethernet interface offers an Ethernet to serial gateway similar to the one offered by the AAX0004. Its IP address by default is 192.168.127.253 and, like the other Ethernet communication accessories, it accepts TCP connections at port **7128**.

Please refer to section 7 for further information on the Ingecon Sun Combox Centralised communication hardware.

5.3 Wireless communication

For a typical wireless communication schema, a pc **F** monitors a group of inverters **B, C** and **D** that share a wireless network with the Ingecon Sun Combox accessory **A.**



A – Ingecon Sun Combox.

B –Ingecon Sun units with radio AAX0005.

C – Ingecon Sun units with radio AAX0009.

D –Ingecon Sun units connected to RS-485 bus of **C**.

E –RS-485 cabling.

F – PC local.

G – Cabling from PC to Combox: USB or Ethernet.

5.3.1 General comments

Communication by radio means that there is no need to install communications cabling, thereby avoiding the risk of voltage surges caused by the said cabling.

Radios AAX0005 and AAX0009, together with the master radio installed in the Ingecon Sun Combox communications equipment, form a totally transparent wireless serial bus for the Ingecon Sun Manager software. The bus characteristics are:

Communication on band ISM868.

Radiated power 500mW (27dBm).

Radio interface at 19200bps.

Serial interface at 9600bps.

Communication between the Combox and the inverter radios is established in point - multipoint mode. The Combox transmits by broadcast the requests received from a PC and, in the same way as for a cabled system, only the inverter whose node nº coincides with the request contents will respond to the request.

Radio communication between the Combox and the various Ingecon Sun accessories is organised into what have been termed "Logical Zones", such that if the radio in a Combox cannot cover the entire plant area, then a second Logical Zone is configured.

In ideal conditions of direct visibility and high antenas, the radiated power of 500 mW permits a range of various kilometres. However in practice this distance is drastically reduced by the environmental conditions.

By default, all accessories operate in Logical Zone nº 1 and ignore any communication outside their Logical Zone.

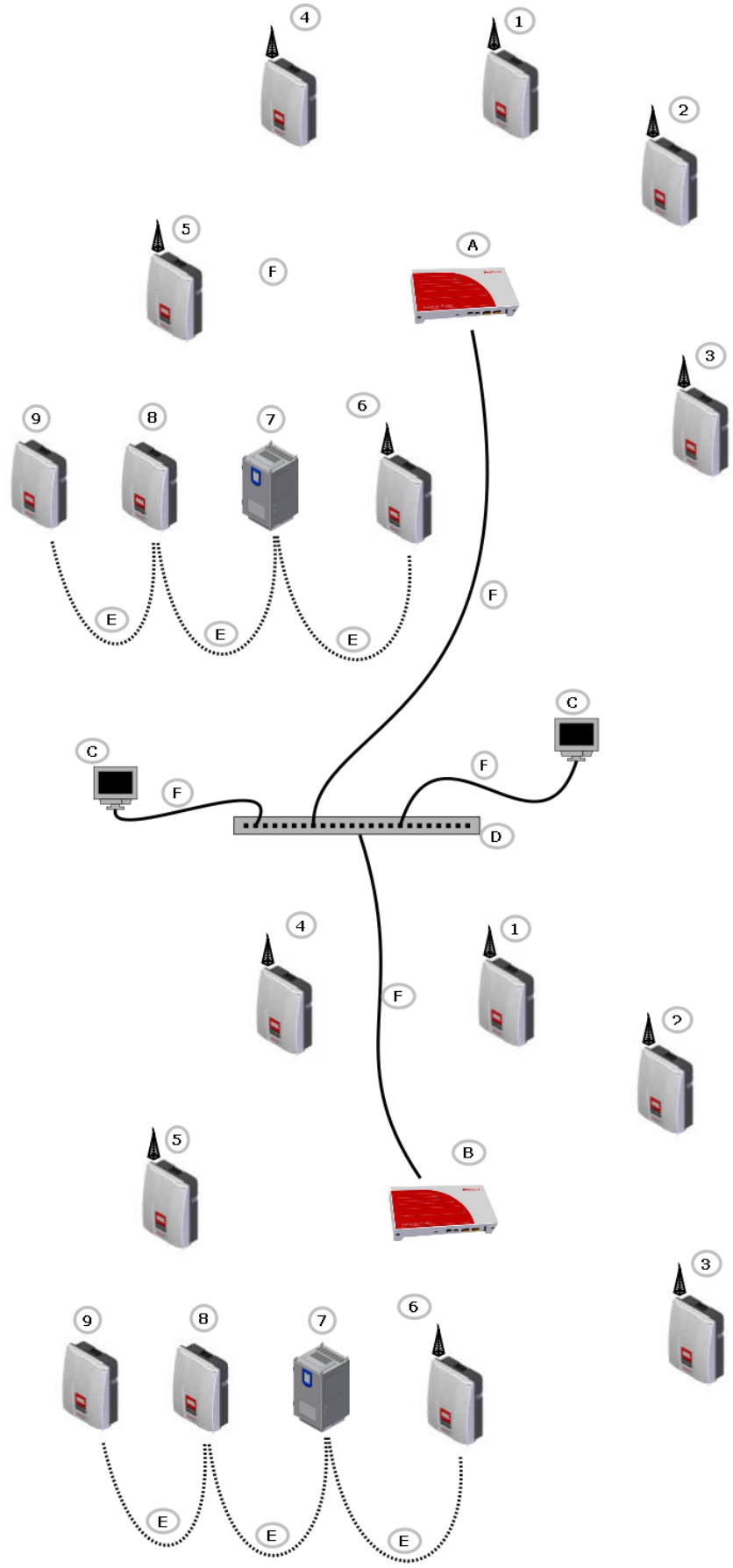
All logical zones share the same radio-electric channel and therefore, simultaneous communication in various zones is not possible.

For example:

In the following communications schema, two Combox **A** and **B**, connected to the same local network, each control a Logical Zone.

As the radios ignore any communications outside their Zone, it is possible to repeat a node nº which is already being used in another zone.

Monitoring is through Ethernet from a local PC and the Combox network address cannot be the same.


4
1
2
5
F
A
3
9
8
7
6
E
E
E
F
C
C
F
F
D
4
1
F
2
5
B
3
9
8
7
6
E
E
E

5.3.2 Wireless communication accessories for Ingecon Sun

5.3.2.1 AAX0005

Board AAX0005 enables wireless communication to an Ingecon Sun unit.

5.3.2.2 AAX0009

Board AAX0009 enables wireless communication to an Ingecon Sun unit and any units connected by RS-485 to the Ingecon Sun.

5.3.2.3 AAX0011

Indicate this kit in your order in order to configure a radio AAX0005 or AAX0009 in a Logical Zone other than 1.

5.3.2.4 AAX0012

Indicate this kit in your order in order to configure a Combox in a Logical Zone other than 1.

5.3.3 Wireless communication ISM868 in the Ingecon Sun units

5.3.3.1 Ingecon Sun Lite

In order to install a wireless communication card in the Ingecon Sun Lite unit, it is first necessary to disable the Rs-485 communication installed as standard. The procedure to do so is described in 5.2.2.1.1. Once this has been disabled, the accessory can be installed.

5.3.3.2 Ingecon Sun Smart, Power and PowerMax, and Ingecon Sun String Control

The wireless communication board, either the AAX0005 or the AAX0009, must be mounted on the control board specific communications connector. For the AAX0009, the RS-485 is made to the board push-pull connector. There is no defined position on the equipment casing to serve as an inlet port for the antenna and RS-485 cabling, if present, but there are a number of auxiliary ports available.

5.3.4 Local PC connection – Ingecon Sun Combox

As shown in the figure above, the local PC can be connected by USB or by Ethernet.

Please refer to section7 for further information on the Ingecon Sun Combox Centralised communication hardware.

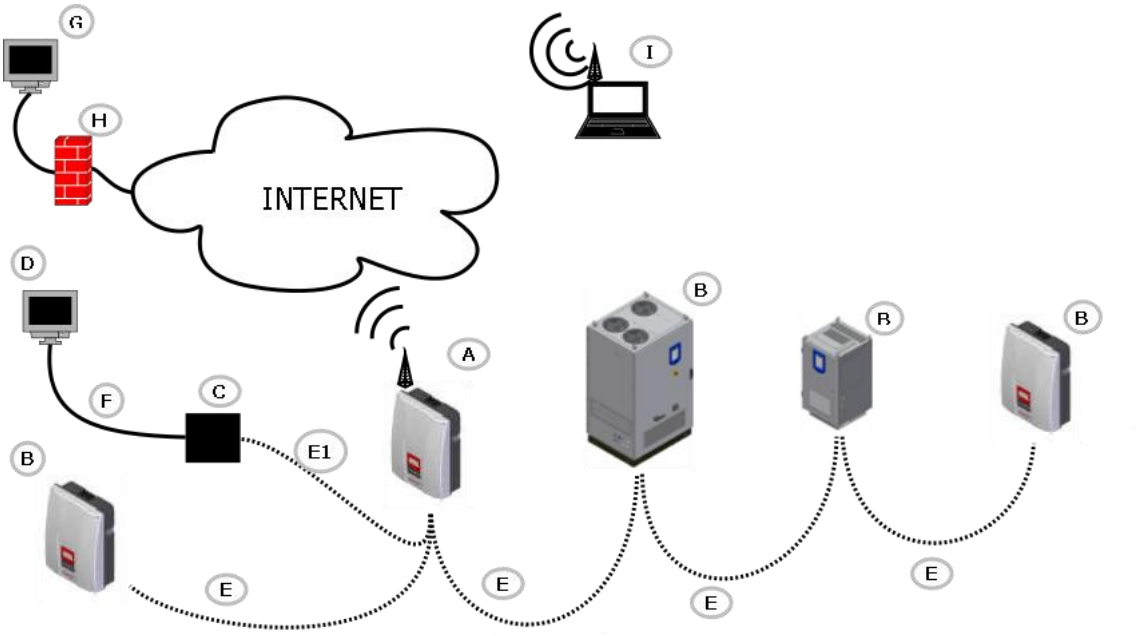
6. REMOTE COMMUNICATION SYSTEM

This section describes the Ingecon Sun accessories and the equipment settings required, the remote PCs and the possible network equipment that could be present in a remote communication system, which is understood to be the communication with one or several Ingecon Sun units from a remote PC.

You are advised to ensure that the local communication is functioning correctly before undertaking the installation of the remote communication system.

Ingeteam supplies accessories for remote communication via a GPRS network and via Ethernet.

6.1 Communication via GPRS



In the typical schema for GPRS communication, an Ingecon Sun unit **A** is equipped with a GPRS modem and this is accessed from a remote computer which can either be a computer **G** in an ADSL network or a computer **I** with a 3G/GPRS card.

The other items are:

B - Ingecon Sun units connected to the RS-485 bus of Ingecon Sun unit **A**.

C - Media converter (RS-232, USB, …).

D - Local PC

E - RS-485 cabling.

F - Cable from the PC up to converter **C**.

G - Remote computer in a network.

H - Remote local network firewall.

I - Remote computer with a GPRS/3G connection.

E1 is the RS-485 cabling section from the media converter to the Ingecon Sun unit equipped with a modem. You are advised to keep the length to a minimum.

In a bus topology, you are recommended to centrally locate the master in order to ensure optimum signal strength to as many slaves as possible.

In a GPRS communication, the bus master is the modem in unit **A**, in charge of transmitting the requests from and to the remote PC.

However, when there is no active CPRS communication, the bus master can be the local PC. Depending on the local PC location and the length of the bus, on occasion it may be recommendable to locate the modem at one end of the bus.

6.1.1 General comments

The GPRS communication is made through the mobile phone operator communication networks. Access to these networks is a service which must be subscribed to by the customer. Likewise, the customer should ensure that the installation has network coverage.

The M2M (Machine 2 Machine) rates are adequate for devices such as the modems in the Ingecon Sun units, which are permanently connected to the network but which have a very low data traffic.

Apart from these rates, each operator uses its own criteria to bill the GPRS communication, which can be based on data volume, connection time or even both.

For this reason, and to avoid unpleasant surprises, it is advisable to monitor consumption during the first few days after installing a communication system of this type.

Alternatively, it is possible to disable the GPRS communication in a modem and it will then perform like a GSM modem. However, a missed phone call is sufficient for the modem to connect to GPRS and wait for a connection during the following hour. Once this hour has passed, it will return to the GSM mode.

The Ingecon Sun modems are supplied as standard with parameters APN (APNSERV, APNUN y APNPW) and which are necessary for M2M communications with the leading cell phone operators in Spain, France and Italy.

It is also possible to establish customised APN parameter, which makes it possible to work with new operators or VPN network services.

6.1.2 Ingecon Sun GPRS accessories

6.1.2.1 AAX0007

Reference AAX0007 corresponds to the supply of modem AAX0001 together with the internal cable and fast-on connector required for the RS-485 serial line communication in single phase equipment prior to 2009.

6.1.2.2 AAX0022

Reference AAX0022 corresponds to the supply of modem AAX0001 together with flat cable AQL0089 and RS-485 cable AQL0089. This reference is adequate for the GPRS communication in the Ingecon Sun Lite units.

6.1.2.3 AAX0018

The various references incorporating the GPRS modem are configured to function in Europe. Request this kit to enable the modem to function in the United States.

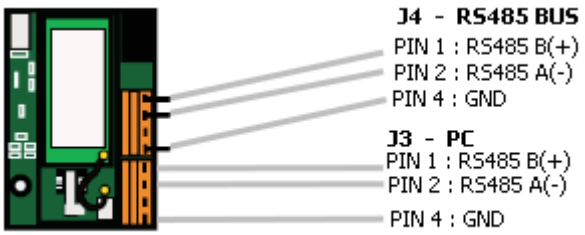
6.1.2.4 AAX0001

Reference AAX0001 corresponds to the modem for three phase units, a basic component for the rest of the GPRS accessories. It comprises a motherboard and superimposed GPRS modem card, the corresponding antenna with its cable and three status indicator LEDs. The antenna is equipped with a magnetic base to secure it in place. The SIM card, which is not included, must be released from its PIN access code.

Push-pull connector Pins	Signal
1	RS-485 B (+)
2	RS-485 A (-)
4	GND

It is mandatory for the inverter fitted with modem AAX0001 to be identified as number 1.

The arrangement of the jumpers on the boards in the other inverters is identical to the arrangement given for the RS-485 line communication, for the intermediate and the end inverters.



6.1.2.4.1 Status LEDs

6.1.2.4.1.1 Red LED

- On: The modem is searching for a GSM network.

- Fast flashing: Busy receiving a call.

- Slow flashing: Connected to the GSM network awaiting calls.

6.1.2.4.1.2 Yellow and Green LEDs

After switching on, the LEDs should go through the following states.

1 - “Two green flashes, followed by two yellow flashes”: AWAITING SIM CARD

2 - Simultaneously green and yellow with "three flashes, pause, one flash, pause". AWAITING LOG ONTO NETWORK (in this status the red light will be on). THE MOST RECENT AAX1000_i VERSIONS WILL WAIT SEVERAL MINUTES WITH THE RED LIGHT FLASHING BEFORE MAKING A LOG-ON CHECK

3 - Continuous green, yellow with " three flashes, pause, one flash, pause": not yet initialised.

4 - Continuous green, yellow with " three flashes, pause, one flash, pause": initialised, not yet logged on to the GSM network

5 - Simultaneously green and yellow with "three flashes, pause", checking the modem setting.

Once the modem setting has been checked, the modem will connect to the GPRS network:

6 - Green, with " three flashes, pause" and yellow off: connecting to the GPRS.

7 - Green with " three flashes, pause" and yellow on: connected to GPRS, notifying IP.

It is ready to receive connections from the Ingecon Sun Manager when:

8 - Green with "four flashes, pause": ready to receive connections, for GPRS and for GSM.

9 - Green with "one flash, pause" and yellow off: only ready for GSM calls (for lack of GPRS coverage or because the GPRS option is disabled).

When the Ingecon Sun Manager is connected to the modem, the states are:

10 - Green with "five flashes, pause": the PC has connected via GPRS.

11 -Green and yellow on: accepting incoming call.

12 -Green with "two flashes, pause": the PC has connected via GSM.

In states 8, 9, 10 and 11 the yellow led indicates the presence of alarms in one of the inverters.

When the modem is checking the inverters for possible alarms:

13 - “Three green flashes, followed by three yellow flashes": communicating with inverters.

Other undesired states:

- Green on, yellow with "two flashes, pause, one flash, pause". NO SIM CARD.

- Green and yellow with "two flashes, pause, one flash, pause": SIM card PIN code request not disabled.

- Green on, yellow with "six flashes, pause": log-on denied.

Warning:

If the antenna has a lead, cover the metal connection with insulating tape to avoid electrical contact with live parts of the system.

To configure the SMS alarms, refer to section "4.2.5.1 Report and Alarm Configuration" in the help section of «AAX2005IKE01 Monitoring Software User Manual» of monitoring program AAX1001, Ingecon Sun Manager, available on the Ingeteam Energy website.

6.1.3 Local communication through the modem

In a group of interconnected inverters, the communication of a local PC with the whole group must be made through the J3 connector of the modem used.

Note: For simultaneous communications, telephone communications have priority over communication with the PC, as the modem is fitted with a relay which opens the connection at the J3 connector.

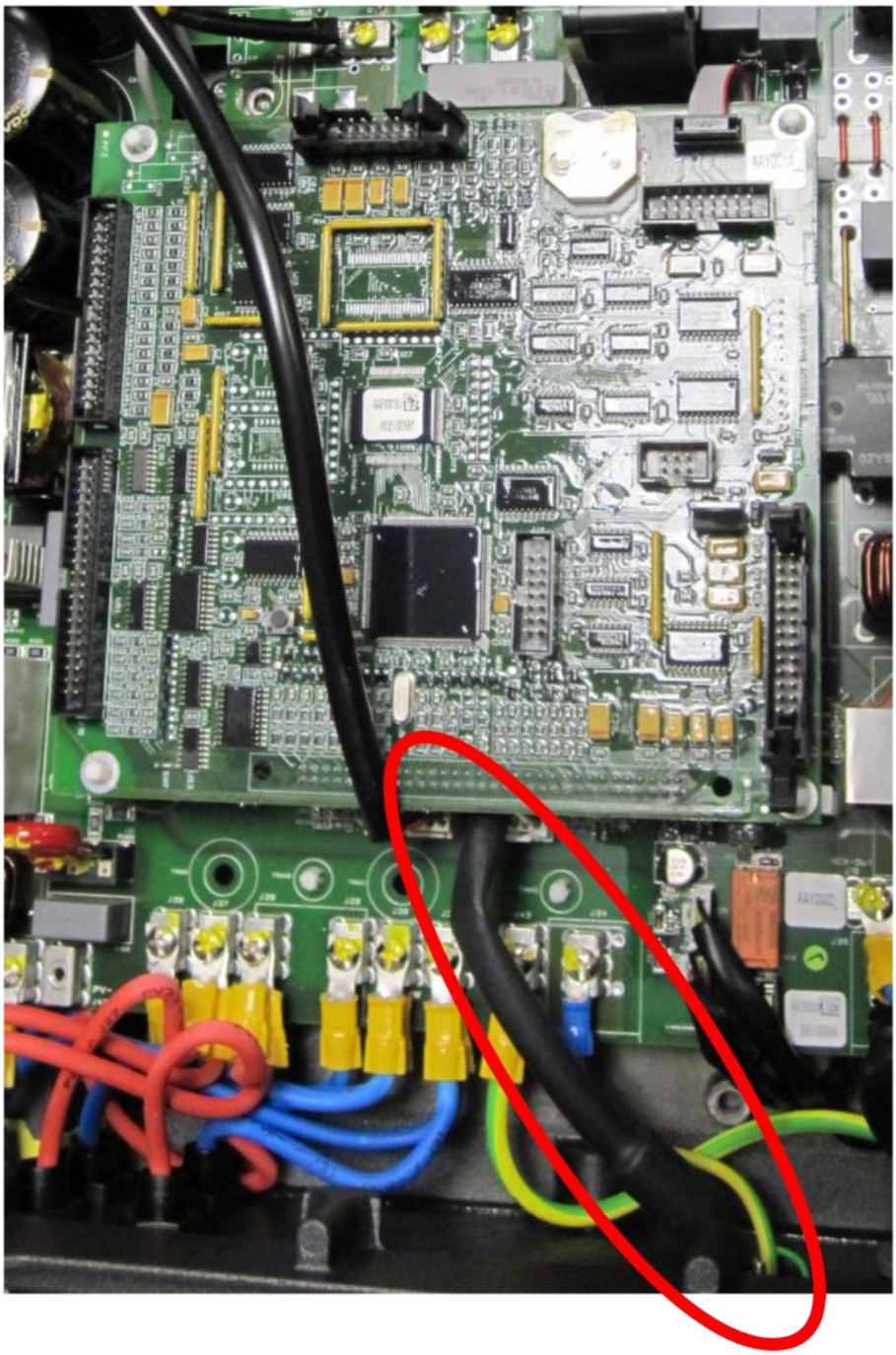
6.1.4 GPRS communication in the Ingecon Sun units

6.1.4.1 Ingecon Sun Lite Units

In order to install a GPRS modem in the Ingecon Sun Lite equipment, the RS-485 communication, installed as standard, first needs to be disabled. To do so, the procedure is detailed in section **¡Error! No se encuentra el origen de la referencia.**.

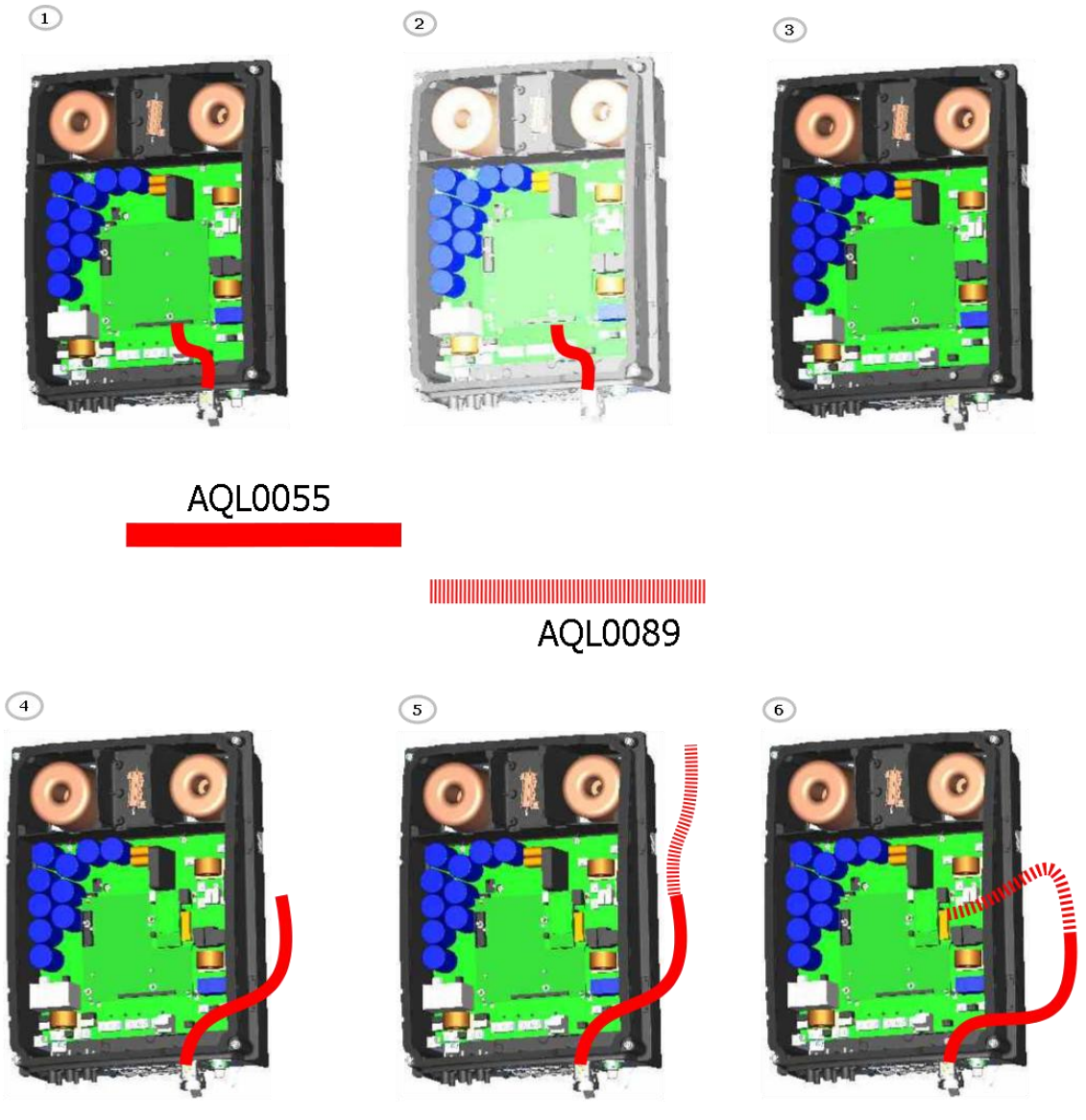
Then locate cable AQL0055.

The location of cable AQL0055 is shown in the following photo. In the installation, the cable connection with the Harting on the equipment casing shall be maintained, however it should be disconnected from the power board printed circuit.



Finally, the accessory should be installed.

1, 2 and 3: Disconnect the AQL0055 cable RS-485 connector from the power board.
4: Connect the modem.
5: Connect cable AQL0089 to the free end of AQL0055.
6: Connect AQL0089 to the modem. As described in the section corresponding to modem AAX0001, selecting the appropriate one to either connect a local PC or a bus of inverters.



6.1.4.2 Ingecon Sun Smart, Power and PowerMax units

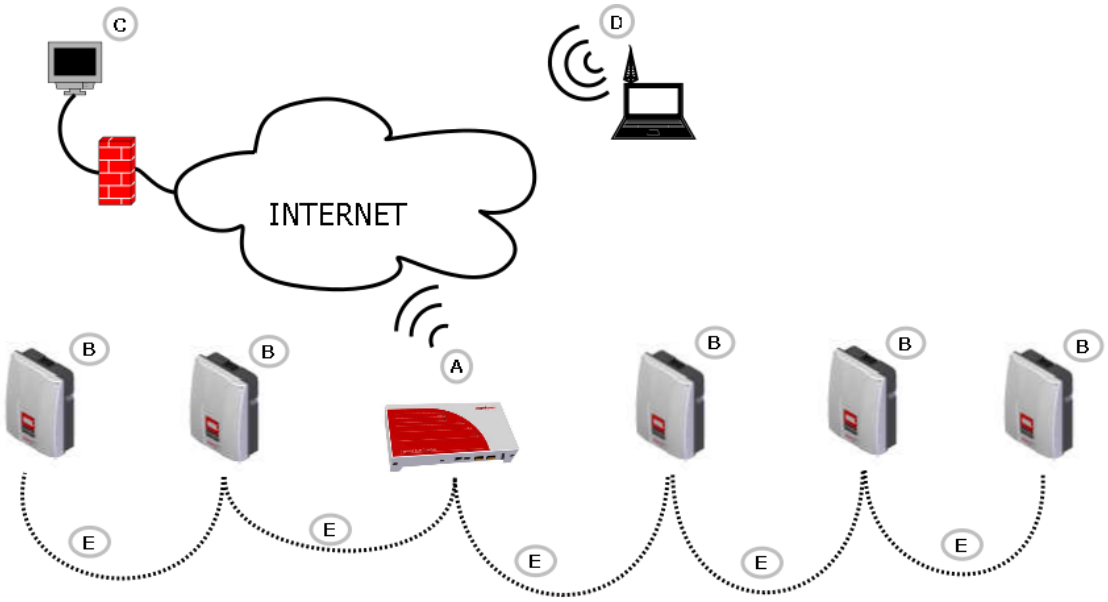
Modem AAX0001 must be mounted on the control board specific communications connector, and the cabling shall be made to the board push-pull connector. There is no defined position on the equipment casing for bringing in the antenna and RS-485 cabling, if present, however there are a number of auxiliary ports available.

6.1.4.3 Units prior to 2009

The AAX0007 should be mounted. Communications modem AAX0001 must be mounted on the control board specific communications connector, and the cabling shall be made to the board push-pull connector. There is no defined position on the equipment casing for passing through the antenna and RS-485 cabling, if present, however there are a number of auxiliary ports available. The appropriate PG diameter should be used for the cabling port in order to maintain the equipment leak tightness.

6.1.5 Ingecon Sun Combox

Optionally, the Combox can include a GPRS modem.



A – Ingecon Sun Combox with GPRS modem

B - Ingecon Sun units connected to the RS-485 bus of Combox **A**.

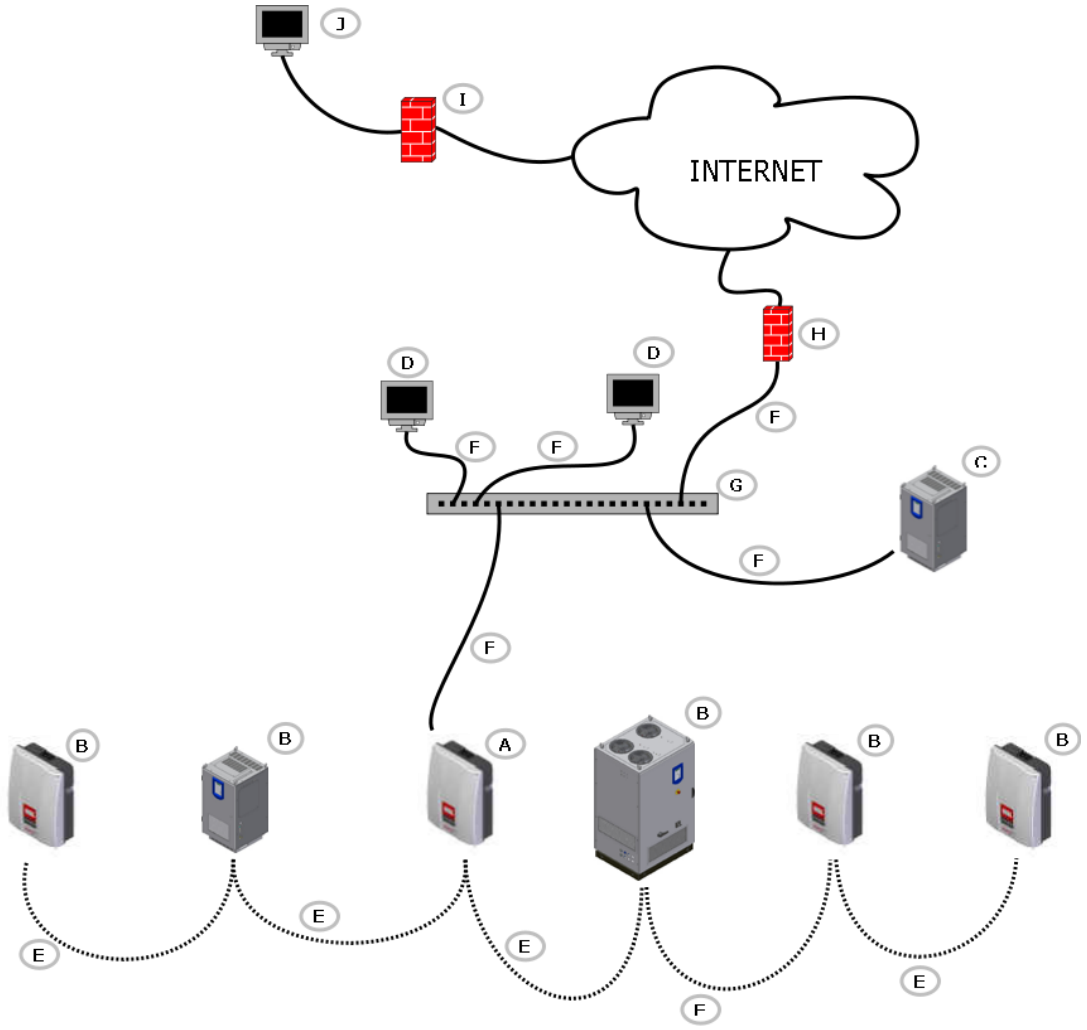
C - Remote computer in the network

D - Remote computer with a GPRS/3G connection.

Please refer to section **¡Error! No se encuentra el origen de la referencia.** For further information on the Ingecon Sun Combox Centralised communication hardware.

6.2 Remote communication via Ethernet

The following figure shows a typical remote communication schema in which the aim is to communicate with equipment items **A** and **B** through computer **G**.



Key:

A - Inverter with card AAX0004 or AAX0023 or Ingecon Sun Power UL unit

B - Ingecon Sun units on the same RS-485 bus as unit A.

C – Ingecon Sun units with board AAP0067.

D – Local PCs

E –RS-485 cabling.

F- Ethernet cabling.

G - Local switch.

H - Local firewall.

I - Remote firewall.

J - Remote computer.

H - Ethernet UTP cabling.

I - RS-485 cabling

6.2.1 Remote communication via Ethernet to the Ingecon Sun units

Taking for granted that the local communication via Ethernet from computer **D** is correct, as far as the Ingecon Sun equipment is concerned, the only thing to be configured is the Default Gateway of the converter installed in unit **A.**

If there are several devices, it will be necessary to change the TCP port number in which the connections are received, so that the same number is not repeated. For example, for three devices, the first would be configured on port 7128, the second on 7129 and the third on 7130.

6.2.2 Connection of the remote PC

For the remote PC, you need to know the public address of router **H** in order to enter it in the plant communications configuration in the Ingecon Sun Manager software.

Router **H** must also be correctly configured:

> Configure the NAT or port redirecting of router **E** to accept incoming connection at the TCP port specified on the converter.
> Redirect the incoming connections through the said port to the private IP of the converter at **A**.
> If there are several converters, repeate the NAT configuration process with its TCP port and corresponding address.

And at router **I**, you need to permit outgoing connections at the corresponding port.

6.3 GSM Communication

6.3.1 General comments

6.3.2 Ingecon Sun GSM accessories

The hardware to be used is as described in section Modem AAX0001 with the GPRS option disabled.

6.3.3 GSM communication with the Ingecon Sun units

As this is the same hardware, section 6.1.4 is applicable

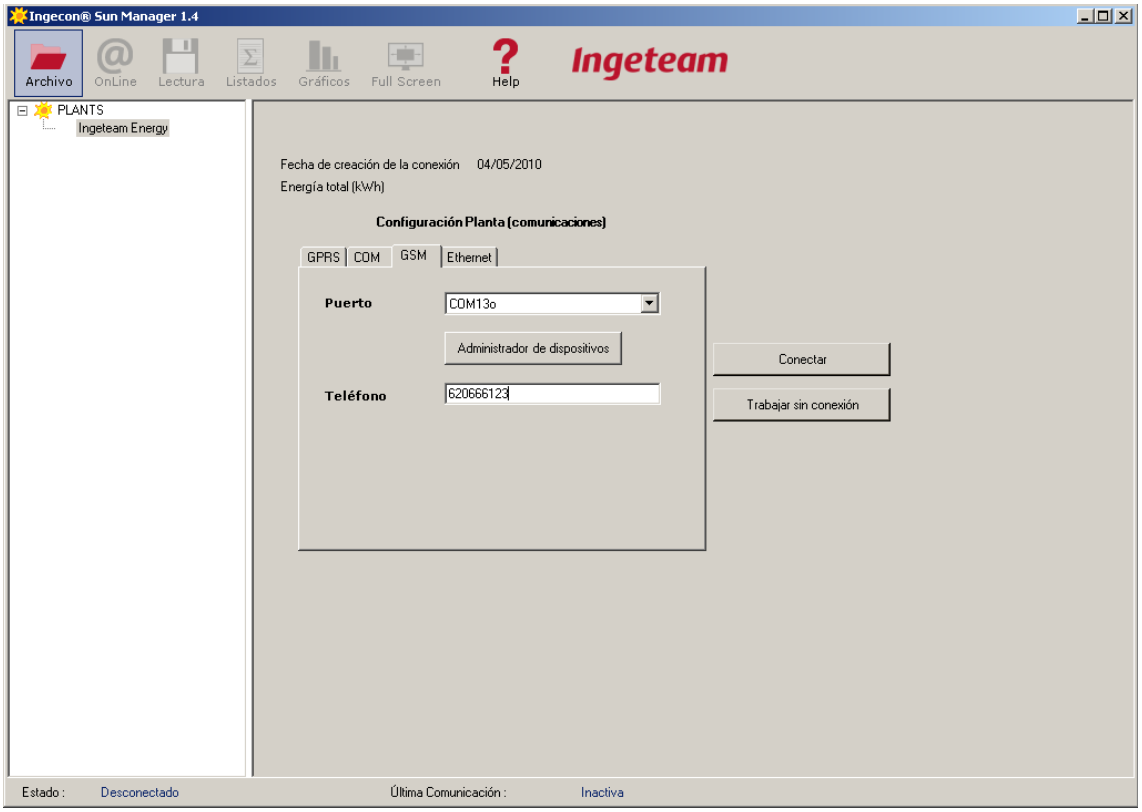
6.3.4 Connection of the remote PC and GSM accessories for PC

6.3.4.1 Modem AAP0059

• The modems are pre-set and, to operate them, they simply need to be connected to the computer serial port.

• In **Opciones -> Configuración comunicaciones** (options - communication setting) select the port number to which the modem is connected.

Enter the phone number and click on connect '**Conectar'**.



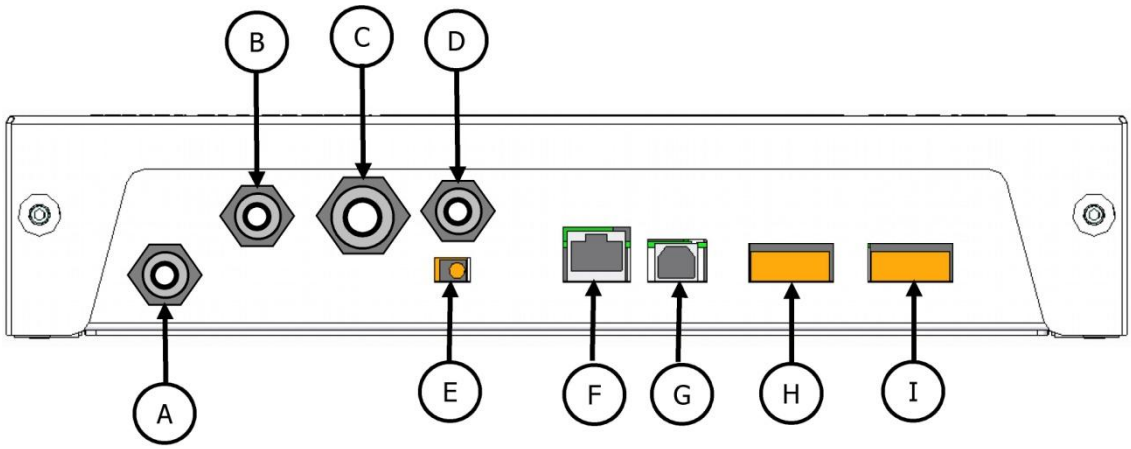
Wait until status "**Estado**" shows connected '**Conectado'**.

7. INGECON SUN COMBOX

The Ingecon Sun Combox Centralised communication hardware, with reference AAX0006, is a multi-purpose accessory offering the following possibilities:

Local connection of a PC to one or several inverters.
Centralised local wireless communication in one installation.
Centralised GPRS communication in one installation.
Historical data capture and recording of meteorological variables.
Historical data capture and recording of the power threshold imposed by the electricity company and send it to the inverters.

The following figure shows where the connections should be made and the PG through which the different cables should be passed.



A - 220V AC Power.

B - Power threshold cables.

C - Sensor cables for the analog inputs.

D - Cables for the modem and radio antennas.

E - Connector for 5V DC power source

F - Connector for Ethernet cable

G - Connector for USB type B cable

H - RS-485 input connector

I - RS-485 output connector.

The Ingecon Sun Combox is equipped with several analog inputs to connect sensors for meteorological variables.

The inputs are:

2 inputs 0..10V or 0..20mA

1 input 0..2V or 0..20mA

1 input 0..400mV or 0..20mA

2 inputs for PT100 wire probe

Finally, the board has 4 digital inputs to control the power that the inverters supply to the grid. The configuration of these inputs is monitored every 30 seconds and if there are any changes, a power change section is broadcast to the inverters.

7.1 AAX0014 - GPRS Modem kit for AAX0006

Optionally, the Combox incorporates a GPRS modem to install in the Combox. This modem is configurable to send SMS alarms and reports in the same way as the GPRS AAX0001 modem.

7.2 AAX0013 - Radio Kit for AAX0006

Optionally the Combox incorporates a radio on band ISM868 for local communication with the Ingecon Sun units.

7.3 AAX0012

Kit AAX0012 (kit to change the Logical Zone in radio AAX0009 for AAX0006) makes it possible to change the Logical Zone of the radio installed in the Combox.

8. FREQUENTLY ASKED QUESTIONS

Is it possible to remotely reconfigure the firmware of a more advanced version in order to optimise the inverter operation?

Firmware reconfiguration must be performed by Ingeteam Energy personnel. In any case, a more advanced version of the firmware installed in an item of equipment does not necessarily mean an improvement in operation. Each firmware version is optimised for a specific topology.

Does the string box communication require a special configuration? Must the inverter function as a gateway when string boxes are connected to the RS-485 network?

No. The string boxes are connected to the RS-485 grid in the same way as the inverters. They function as yet another node. The inverter, therefore, does not function as a gateway to communicate with the string boxes.

Is there a restriction on the number of nodes to be included in a RS-485 network?

Yes. Due to the Modbus protocol design, the greatest number of nodes is 247, although in practice the environment conditions will make it difficult to establish correct communications with this number of machines and installations are frequently planned with various independent buses.

Is it possible to view the inverter data via the remote connection when the inverter is switched off?

Yes, provided that the inverter is powered through an uninterrupted power system (UPS). Obviously in these circumstances any instantaneous variables such as production, power or output current will be shown with value of zero.

Can a GSM modem be configures as a GPRS modem?

Modems manufactured later than January 2007 have this GSM or GPRS configuration option. This configuration is made through the INGECON SUN MANAGER application. The units manufactured prior to this date are only for GSM communication and cannot be configured for GPRS.

What should be done if there is no connection with the equipment via GSM/GPRS?

You first need to check whether the installation has coverage. The coverage status can be determined through the status of the corresponding LED (see page 22 of the manual).

With the red LED continually on, the modem has no coverage (it is looking for a network).

In order to view the LEDs, the equipment needs to be opened. This should be done following the general safety conditions included in this manual.

Should you have any doubts with regard to whether the SIM card is operating correctly, disconnect the equipment, wait 10 minutes and then remove the SIM card and test it in another unit in which you are sure that communications are correct.

Should you detect a SIM card malfunction, contact the Phone Company supplying the card, which should confirm whether the card needs reconfiguring or is damaged.

Never remove the SIM card with the equipment connected to the power supply. In addition to the obvious risk to persons, you are very likely to damage the SIM card.

If the SIM card is shown to function OK, then repeat the operation with the modem to check that this is not damaged.

9. IMPORTANT SAFETY CONDITIONS

CAUTION

The operations detailed in this manual can only be performed by suitably qualified personnel.

You are reminded that it is mandatory to comply with all applicable safety legislation for electrical work. There is an electrical discharge hazard.

It is mandatory to read and understand this entire manual before manipulating, installing or operating this equipment.

CAUTION

Qualified personnel as referred to in this manual means personnel who at least meet the requirements of all safety standards, rules, regulations and legislation applicable to the equipment installation and operating tasks.

The responsibility of appointing qualified personnel shall always fall to the company at which the said personnel is employed. This company must decide which worker is suitable for each specific task, in order to maintain worker safety and comply with all occupational safety legislation.

The said companies are responsible for providing their personnel with adequate training in work with electrical equipment and for ensuring that such personnel is familiar with the contents of this manual.

CAUTION

The opening of the doors to the various cubicles in no way implies that there are no live parts inside.

Access is restricted to qualified personnel, following the instructions set out in this manual.

CAUTION

There is an electrical discharge hazard, even after disconnection from the grid and PV array.

CAUTION

For Inspection, Operating and Manipulation tasks, it is mandatory to strictly follow the indications set out in section **4 Safety instructions.**

CAUTION

Perform all the operating and manipulation tasks with no voltage present.

As a minimum safety measure for this operation, the 5 Golden Rules must be followed:

1) Disconnect

2) Prevent any possible re-connection

3) Check that no voltage is present

4) Ground and short-circuit

5) Protect against nearby live equipment, where appropriate, and place safety warning signs to demarcate the work area.

Non-live work cannot be authorised until all five steps have been completed. Therefore, any work prior to compliance with these steps shall be considered to be work on live parts.

The basic country-specific safety regulations recommended by Ingeteam Energy S.A. are as follows:

- RD 614/2001 in Spain.

- CEI 11-27 in Italy.

- DIN VDE 0105-100 and DIN VDE 1000-10 in Germany.

- UTE C15-400 in France.

CAUTION

Compliance with the safety instructions set out herein or with the suggested legislation, is additional to compliance with other standards and regulations specific to the installation, place, country or other circumstances affecting the inverter.

CAUTION

To check that no voltage is present, it is mandatory to use: class III - 1000 volt testers

Ingeteam Energy S.A. assumes no liability for any damage caused by the improper use of its equipment.

POTENTIAL HAZARDS TO PERSONS

Indicated below are the principal injuries to persons that could be derived from the incorrect use of the equipment.

HAZARD: Electric shock.

The equipment may still carry a charge even 5 minutes after disconnecting it from the PV array and power supply.

Strictly follow the mandatory voltage disconnection steps contained in this manual.

HAZARD: Explosion.

There is a highly unlikely risk of explosion, in very specific cases of malfunction.

The housing will only protect persons and property from such an explosion, if it is correctly sealed.

HAZARD: Crushing and joint injuries

Always follow the instructions contained in the manual when moving and positioning the equipment.

This equipment is heavy and can cause injuries, serious wounds and even death if not handled correctly.

CAUTION: High temperatures.

The airflow through the side and upper outlets can reach high temperatures which could cause injuries to anyone exposed to this hot air.

The equipment rear and sides function as a radiator. Do not touch these parts, there is a severe burn hazard.

POTENTIAL HAZARDS TO EQUIPMENT

Indicated below are the principal damages that could be caused to the equipment through misuse.

CAUTION : Ventilation.

The equipment requires a good quality airflow during operation.

It is essential to keep the unit upright and not to obstruct the air inlets, in order to ensure that the equipment interior is well ventilated.

CAUTION: Connections.

Following any duly authorised manipulation work, before reconnection, check that the inverter if completely ready to operate.

CAUTION: Electronic damage.

Do not touch the electronic boards or components. The more sensitive components could be damaged or destroyed by static electricity.

CAUTION: Operation.

Do not disconnect or connect any terminals whilst the equipment is operating. You must first disconnect the equipment and check that no voltage is present.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

CAUTION: The standard personal protective equipment is:

- Safety glasses to protect against mechanical hazards
- Safety glasses to protect against electrical hazards
- Safety footwear
- Helmet

The specific situations in which each particular PPE is used are set out in Section 4.

NOTAS

NOTAS

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